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Graphite

for the
Boiler

Joseph Dixon Crucible Co
Jersey City, N.J. U.S.A.



Established 1827





INTRODUCTION

DIXON'S Pioneer Boiler Graphite is not a cure-all, but it is offered as the most nearly perfect solution of a troublesome condition. Although experience proves that no power plant accessory can please everyone, common sense would indicate that flake graphite is an excellent medium through which to attack boiler scale. The formation of scale can rarely be prevented by any kind of treatment, but flake graphite checks it from burning fast to the metal and thus renders a great service at cleaning time.

There is no objection to using both graphite and chemicals if you desire to take advantage of the best features of each.

In any case keep clearly in mind how the action of graphite differs from that of chemicals, give it a fair trial for several months, and then compare the cost of material and cleaning with previous figures.

We are mistaken if you do not stick to the graphite treatment for boiler scale.

Do not confuse Dixon's Pioneer with ordinary boiler graphite.

BOILER GRAPHITE FACTS

EVERYONE knows that to some extent all waters contain mineral or vegetable impurities, either in suspension or solution, and that when water is evaporated in a boiler most of the impurities are left behind. They are either deposited in solid form on the metal surfaces, forming what is known as scale, or settle as a sludge and are passed out through the blow-off.

Cost of Scale

Scale lowers the conductivity of the boiler heating surfaces and makes business for the coal dealers. Researches which determined just how poor a conductor scale actually is were made at the University of Illinois. The heat retarding effect of different kinds of scale in the table below is calculated from the figures obtained from these tests.

The table is based on coal at a uniform price of \$2.50 for a ton of 2,000 pounds, delivered at the boiler room. Each plant is assumed to run at full rated capacity for 300 days of 10 hours each during a year. Certain average rates of coal consumption have been taken for the different sizes of plants, varying from 3½ pounds for a horse-

power hour in the smallest plant, to 2 pounds for a horse-power hour in the largest size mentioned.

If coal costs more or the number of running hours is higher, the costs for clean boilers and the loss due to scale will both be increased in proportion.

Horse Power of Plant	Yearly Cost of Coal with Clean Boilers	Extra Cost (or Loss) Each Year Caused by Scale According to the Thickness				
		$\frac{1}{32}$ in.	$\frac{1}{16}$ in.	$\frac{1}{8}$ in.	$\frac{1}{4}$ in.	$\frac{1}{2}$ in.
100	\$1,312	\$111	\$162	\$243	\$370	\$595
200	2,624	222	324	486	740	1,190
300	3,936	333	486	728	1,110	1,785
400	4,500	381	557	833	1,270	2,035
500	4,688	397	581	867	1,323	2,125
750	5,825	476	696	1,040	1,587	2,550
1,000	7,500	635	930	1,387	2,116	3,995
1,250	9,375	794	1,160	1,733	2,645	4,245
1,500	11,250	952	1,391	2,079	3,175	5,100
2,000	15,000	1,270	1,859	2,773	4,232	6,802

This table shows the money loss which any power plant owner may suffer as a penalty for not keeping his boilers clean.

One-sixteenth inch of hard scale reduces the efficiency of a boiler fully 12%, and one-eighth inch scale reduces the efficiency fully 18%.

Danger of Scale

Scale is also highly dangerous, for whenever it accumulates to any great extent at a part of the shell or tubes exposed to high temperatures, it prevents the cooling action of the water

from protecting the metal against burning. The plates frequently become overheated to such an extent as to bag or crack. This is a common source of explosions, for the weakened parts finally give way to the strain upon them.

There is an average of more than one serious boiler explosion in this country every day, resulting in several hundred deaths and injuries each year.

Scale Remedies

The so-called remedies for scale are legion, but none of the ordinary preventatives are more than partly successful. They undoubtedly do some good, but do not remove *all* the scale, while some of the chemical preparations really do more harm than good. A metal boiler is not a proper vessel in which to carry on chemical reactions. Pitting and corrosion of valves and fittings prove this statement to be true.

Since nothing has been found to absolutely prevent the formation of scale, it is reasonable to employ some means to more easily and safely remove the scale that does form. The answer is *fine flake graphite*. We

have sold flake graphite for this purpose for many years.

The great saving of time and expense brought about by the use of Dixon's Boiler Graphite cannot be appreciated until it has been tried. In our own plant there was a time when it cost about 35 cents to clean each tube of the B. & W. boilers, whereas the present cost is only about 8 cents per tube, and the work is done by one-half the men in one-third the time. What was formerly a hard scale can now be turbined without difficulty. It used to take a man from three to four days to clean each drum, but now he cleans three drums in a day and a half. A wire brush does the trick.

The saving effected in the time and expense of cleaning most boilers is many times the cost of the graphite.

Function of Graphite

The action of graphite is not chemical, nor does it attack metal, as is often the case with strong compounds; neither is it affected by any acid in the water or by the heat generated in the boiler. Particles of graphite simply work through the minute fissures existing in the old scale and gradually penetrate between the scale and the metal. The scale thus loosened may

be rapped off or removed with regular cleaning tools with little trouble.

It must be understood that if the scale is very hard and thick, as long as three or four months may pass before graphite has any apparent effect. Even then scale may not fall down, but—and this is vital to remember—most of it can be removed easily with cleaning tools. Once removed, scale will not adhere firmly to the metal again as long as the graphite treatment is continued. Graphite also becomes thoroughly intermixed with new scale as it forms, rendering it soft and crumbly. In short, Dixon's flake graphite makes boiler cleaning positive and easy.

Advantages of Graphite

Its use—

- Lessens the time required for cleaning,
- Noticeably increases the steaming capacity,
- Reduces fuel consumption,
- Prevents pitting,
- Minimizes repairs,
- Improves operation of feed pumps,
- Does not injure valves and gaskets on steam lines,
- Prolongs the life of boilers.

The action of flake graphite is purely mechanical. It may be used in

any feed water and any type of boiler. It does not deteriorate as compounds do. It will not evaporate or dissolve. It cannot cause "foaming," nor under normal conditions can it pass from the boiler with the steam and render it unfit for industrial purposes. For this reason it finds special favor in ice plants, laundries, milk plants, canneries, etc. It may be used in conjunction with your regular boiler compound in case the scale is of a very hard sulphate nature.

FICTION AND TRUTH

IN spite of reports to the contrary, graphite will not corrode boilers. Laboratory tests sometimes quoted to show that graphite aids corrosion have no bearing whatever upon conditions *inside* a boiler where air is not present. In direct opposition we positively claim that a coating of graphite on the boiler interior is the best protection against acids in the feed water. It is for this reason that in many plants the interior of steam drums is painted about every ten months with Dixon's Silica-Graphite Paint. This treatment will keep drums in perfect condition for years.

You may be told that a coating of graphite on the metal is as bad as

scale deposit, because it will not transmit heat. Wrong again. One of the reasons graphite is used in making crucibles for melting metals is that it is an excellent heat conductor.

The action and effect of graphite in boilers is truly summed up in the following extract from "The Production of Graphite in 1914," published by the Department of the Interior at Washington, D. C.:

"The two uses of graphite that seem to have shown the greatest gains during the year are its application to automobile lubrication and its use as a preparation to loosen boiler scale. The effect of the graphite in the boilers is mechanical, not chemical. Being chemically inert, it cannot injure the iron of the boilers or affect the quality of the boiler water. It does not prevent the formation of scale, but the fine graphite particles by mixing with the scale during its formation render it soft and crumbly and prevent it from adhering strongly to the boiler. It can then be easily removed. It is said, moreover, that graphite is efficient in loosening old scale, the graphite particles working into the pores of the scale and between the scale and the boiler."

KIND OF GRAPHITE TO USE

AS THE largest graphite concern in the world, we are naturally in a position to select our boiler graphite from many grades. We know that

many forms of graphite carry large percentages of undesirable impurities which, instead of loosening scale, actually aid in its formation. Some graphite, particularly the amorphous or powdered variety, often has a tendency to form into pasty or mud-like masses in the presence of water. This is one of the reasons why we always recommend the use of *very finely ground flake graphite of good quality*, although we can furnish the amorphous graphite if it is desired.

Experience shows that flake graphite will be distributed more evenly on the surfaces of the shell and tubes and become more permanently attached to the metal than the amorphous kind. This means that the effect of flake graphite persists longer after each application, and consequently less if it is required after the old scale has once been removed.

The Committee on Water Service (1915) of the Railway Engineering Association reported that the *flake* or crystalline form of graphite is superior to the amorphous or powdered form for treating boiler scale.

PRICE OF DIXON'S PIONEER BOILER GRAPHITE

Pioneer Boiler Graphite No. 2 is a good quality of finely ground flake graphite, and is recommended where the very best results are sought. Barrels weigh about 400 pounds.

50 lb. Box	100 lb. Keg	Half Barrel	Barrel
17c. lb.	16c. lb.	15c. lb.	14c. lb.

PRICES ARE F.O.B. NEW YORK CITY

Prices of amorphous graphite will be furnished upon request. Please remember that this form of graphite is not recommended by us for use in boilers.

DIRECTIONS

NO set rules can be given for the amount of graphite to use in a boiler, because this will depend upon local conditions, such as the amount and nature of the scale-forming material in the water. Each engineer should study his own requirements, but experience has shown the following schedule ordinarily to be the best for using Dixon's Boiler Graphite.

For each boiler each day of twelve hours:

Up to	100 H.P.	use	pint
"	150	"	"
"	200	"	"
"	250	"	"
"	300	"	"
"	350	"	"
"	400	"	"
"	450	"	"
"	500	"	"

One pint of Dixon's Boiler Graphite is equal to about one-half pound.

These rough rules are for flake graphite, double the amount if amorphous graphite is used.

After all the old scale has been removed, the daily injection of graphite may be decreased slightly. It is the regular introduction of small amounts of graphite that brings about the most satisfactory results. In addition to the above, put about two quarts of graphite into a boiler each time after cleaning. The water will aid to distribute it evenly over the heating surface.

Wherever possible it is well to swab clean metal with a paste of graphite and kerosene or linseed oil in order to more quickly establish a graphite coating.

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Keep boiler graphite away from grease or oil. Oily graphite will not mix with water.

HOW TO FEED GRAPHITE

THE simplest and best way to feed Dixon's Boiler Graphite is to mix the required amount with hot water and feed it through the pump suction direct to boilers after blowing down about two gauges. One of the advantages of this method is the improved operation of pumps and water meters due to the lubrication furnished by the graphite.

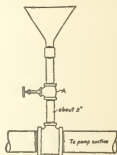


Fig. 1

Fig. 1 illustrates all the special apparatus necessary. Mix the dry graphite in a pail of hot water and pour it into the funnel while valve A is closed. Then open valve A and

permit the mixture to be drawn into the pump. Close A as soon as all the water has left the funnel. In case the pump valves leak and do not readily draw the mixture from the funnel, partly close the valve on the main suction line until the mixture has disappeared.



FIG. 1

Another suggestion is shown in Fig. 2. A piece of 4-inch pipe about 30 inches long is fitted with a watertight cap at one end and the other end connected to the suction pipe through a valve.

To begin operations, pour in the required dose of graphite mixed with sufficient hot water to fill the chamber. Close valve A. Then crack valve B a little.

This arrangement will feed graphite slowly all day and will give more satisfactory results than the device shown in Fig. 1. A few days' experience will show just how much the valves should be opened to obtain the proper rate of feed. Any other apparatus employing the same principles will work equally well. A sight-feed glass can be added to good advantage.

Graphite will mix more readily with hot water than with cold water.

If the boilers are in a battery, care should be taken that each boiler receives its share of graphite.

GENERAL INFORMATION

ANY boiler using bad water should be blown down a gauge or two every few hours to remove the sludge.

Bear in mind that graphite does not prevent the formation of scale. It only serves to help you remove scale with comparative ease. So keep your cleaning tools handy and use them at regular intervals. It may be several weeks before the beneficial action of graphite is noticed, for it works slowly, though surely. The longer you use it the better you will like it.

If maximum results are to be realized from the use of graphite, the boilers must be cooled down thoroughly before they are opened, and the drums should be washed immediately with a large hose and high water pressure. The scale will be soft mud when wet, but will get hard when it dries.

It is much easier to wash the surfaces and then scrape them than to allow the accumulation to solidify and then pound it loose with a hammer. Do not take off the tube caps or the man-hole covers and allow a boiler to stand over night before washing and turbinizing. Take the tube caps off and put the turbine through the tubes as fast as possible. Then if any scale of consequence still remains, replace the cutters on the turbine cleaner with new ones and go through the tubes carefully the next day.

On the other hand, some scale breaks down with surprising rapidity, and it is, therefore, *important* to examine the boiler frequently after beginning the use of graphite to prevent an accumulation of loosened scale on the parts. Such an accumulation may result in a badly damaged boiler. After the old

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scale has been entirely removed, boilers can be run for longer periods without danger.



Showing Bags due to Sediment

Many boilers that are supposed to be in good condition are in reality badly pitted. Dixon's Boiler Graphite will remove the scale and disclose the unsuspected pits so that means may be taken to prevent further corrosion.

Oil in Boilers

Condensed exhaust should be passed through an efficient oil separator, before it is taken into a boiler. Oil in a boiler is particularly obnoxious, for its presence in any large quantity is almost sure to cause bagging. In this connection it is well to state that there need be scarcely any oil in ex-

haust steam if the engine cylinders are properly lubricated. Flake Graphite is the ideal cylinder lubricant, oil being required only to distribute the flakes over the valves and walls. Half the oil ordinarily used is sufficient, if supplemented with Dixon's Flake Lubricating Graphite. The advantages are: saving of oil; cleaner exhaust; better lubrication; no danger, even if oil supply should fail for a considerable time. We will be glad to tell you how to feed graphite to cylinders, if you will let us know the kind of lubricating system you are using.

There are several varieties of flake graphite. Do not confuse Flake Boiler Graphite with Flake Lubricating Graphite. The former is not suitable for lubricating machinery.

Painting Metal Work

In addition to the daily injection of graphite we advise painting the interior of boiler shells and drums at least once a year with Dixon's Silica-Graphite Paint. The reproduction shows the excellent condition of a drum painted every ten months. The little scale, if any, that remains in drums thus treated may be removed with a wire brush. This is a decided

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improvement over the antiquated, laborious method of chipping out scale with a hammer and chisel.



Dixon's Silica-Graphite Paint is the most durable paint on the market, and is without equal for protecting metal from corrosion. The outside of boilers should be painted with it at the time of installation to protect them against dampness. Of course it should

be used on boiler fronts, smoke flues, metal stacks and all metal work about the plant.

WHAT USERS SAY

THE following letters are typical of many we have on file. They are sufficient to indicate the uniform success that has attended the use of Dixon's Boiler Graphite in all kinds of industries in all parts of the country.

St. Louis, Mo., Jan. 7, 1919

Gentlemen:

It has always been our plan to give no letters of testimony. However, it is needless to say that Dixon's Pioneer Boiler Graphite is giving us entire satisfaction, as we have been using it now over three years.

We will be glad to answer inquiries as to the value of this article should you refer any prospective customers to us.

Yours truly,

(Name on request.)

Towanda, Pa., Aug. 4, 1918

Gentlemen:

We wish to advise that we have been using Dixon's Pioneer Boiler Graphite No. 2 for the past four years. We find it to be the best cleaner for boilers that we ever tested. Mr. Repps, who inspects our boilers for the Hartford people, tells us that we have the cleanest boilers that he has the pleasure of inspecting. We would under no consideration use any other cleaner.

Yours truly,

J. O. Frost's Sons.

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ROBERTS BROS. FLOUR MILLS

Warsaw, N. Y., Feb. 1, 1919.

Gentlemen:

In reply to your inquiry relative to the use of graphite in our boilers during the last four and a half years, will say that I use 4 pounds after cleaning once in four weeks and $\frac{1}{2}$ pound per week while the boiler is in operation. This keeps the boiler, which is a 125 H. P. Return Tubular, in good condition.

I have tried several different graphites, but find that Dixon's Boiler Graphite No. 2 gives the best results.

Very truly yours,

(Signed) _____,
Engineer.

HOTEL TULSA

Tulsa, Okla., June 6, 1918.

Gentlemen:

We are very much pleased with the use of your Graphite for our boilers. Have been using it now for nearly five years.

Wish to enter another order for 100 pounds to be shipped to us as soon as possible. Thanking you for an early shipment, we remain,

Yours very truly,

Hotel Tulsa,

Per Chief Engineer.

THE INTERSTATE LUMBER CO.

Quitman, Ga., Jan. 7, 1919

Gentlemen:

Replying to your favor of recent date, beg to say that we have been using your boiler graphite for five years and we are getting excellent results. We are giving your salesman an order for a barrel today.

Yours truly,

Interstate Lumber Co.

New York City Jan. 26, 1919

Gentlemen:

It may interest you to know how about fifteen years ago, when in charge of the Arbuckle Sugar Refining Plant, foot of Pearl Street Brooklyn N. Y. I overcame some very serious trouble with my boilers.

The plant was equipped with H. & W. Boilers, developing 8400 H. P. The trouble was caused by pitting in the steam drums.

After trying various suggested remedies with but little success I got some of your Soda-Graphite Paste and, after cleaning them, painted each of the drums inside, allowing them 48 hours to thoroughly dry.

Up to the time I left Arbuckle's, four years later, these boilers were treated this way every ten months. Not only did I stop the pitting, but where previously it had taken six men seven days to clean the drums of one boiler, two men now cleaned them in a day.

I can certainly recommend the Soda-Graphite to any engineer who has boilers that are giving him trouble of this nature.

Truly yours,

P. Healy, Chief Engineer,

N. Y. Life Insurance Building.

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ASHEPOO FERTILIZER CO.

Charleston, S. C., Jan. 24, 1919.

Joseph Dixon Crucible Co.,

Jersey City, N. J.

Gentlemen:

We have been getting excellent results from the use of Boiler Graphite for the past four years. It is fed to the boilers as follows:

Eight ounces are mixed in a barrel of water, which is connected to the pump suction by a $\frac{1}{4}$ " pipe. A valve in the pipe regulates the flow so that the barrel is emptied four times in twenty-four hours. The graphite is kept from settling in the barrel by means of a small steam circulator.

Upon opening a boiler we find that the scale-forming matter has settled to the bottom in the form of mud which is easily washed out. The water we use is taken from Artesian wells 300 feet deep.

If anyone who uses Artesian well water in their boilers is troubled with scale we would recommend the use of Dixon's Boiler Graphite No. 2 to overcome this trouble.

Yours truly,

H. M. Simons, *Engineer.*

It was with much interest that I read the correspondence in *Ice and Refrigeration* on the question of removing magnesia scale from boilers. In March last, the Federal Milk Proprietary, Ltd., for whom I am acting as consulting engineer, commenced operations at Bacchus Marsh,

using well water for the boiler. At the end of one month I found the boiler so heavily coated with magnesia scale that it was absolutely necessary to change the feed water from the well to the town supply; this supply was not so heavily charged with magnesia, but contains a good percentage of it and is not considered good water for boilers.

I was advised to use with the feed water a certain amount of boiler graphite daily, and the question then arose: Would the fine particles of graphite be carried over in the steam and affect the milk, as in the process of manufacturing condensed milk the live steam comes into direct contact with the milk? But after six months' trial no trace of it has been found in the milk. The amount of graphite used daily was about three ounces. About two inches of water was blown out of the boiler every day.

At the end of six months, using the boiler seven days per week, it was opened and carefully examined. The result was most gratifying; there was no trace of any fresh deposit of scale on the tubes and plates, and, further, a great part of the former deposit of scale was removed and without any washing out the boiler was cleaner than when it was examined six months previously. The fine particles of graphite find their way in between the scale and the steel, so that that scale gradually works off.

The freshly precipitated magnesia was so thoroughly mixed with the graphite in the bottom of the boiler in the form of slime that it was easily washed out, and I fully anticipate in another six months to find the boiler freer of scale than at present.

J. Borrie, V. I. E.,

Melbourne, Australia.

OTHER NECESSITIES

Dixon's Ticonderoga Flake Graphite

Of great value as a lubricant for cylinders, valves and bearings, either alone or mixed with oils and greases. Indispensable for coating gaskets and packing, for pipe-fitting, etc. Ask us how to save half of the cost of cylinder lubrication.

Dixon's Graphite Joint Compound

Cheaper and more convenient than home-made graphite joint dope. All pipe joints, boiler tube caps, gaskets, etc. should be protected with this preparation. Joints can always be opened without damage to fittings.

Dixon's Waterproof Graphite Grease

For gears, wire rope, cables and chains, pump and elevator plungers and heavy bearings. Impervious to fresh or salt water, to acid or alkaline water.

Dixon's Graphite Cup Greases

Due to the flake graphite in these greases, they give longer and better service than is possible for ordinary cup greases. Prepared in six degrees of hardness.

Dixon's Silica-Graphite Paint

For every class of exposed wood or metal surfaces—roofs, buildings, fences, smokestacks, boiler fronts, etc. Four standard colors of only one high quality.

Dixon's Graphite Brushes

For dynamos and motors. Prevent wear of the segments, save regrinding of the commutator, stop sparking and pitting.

Dixon's Solid Belt Dressing

For leather, rubber or canvas belting. A handy dressing that instantly stops all slipping and cannot clog, harden, or otherwise injure the belt.

CORRESPONDENCE SOLICITED

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JOSEPH DIXON Crucible Company

Miners, Importers and Manufacturers
of Graphite

HOUSE ESTABLISHED 1827

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OF THE KIND IN THE WORLD*

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GRAPHITE PRODUCTS, Ltd.
218-220 Queen's Road, Battersea, London, S. W.